

***TOWARD DECODING THE MORPHOLOGY OF MILLIMETER WAVELENGTH
DOPPLER RADAR SPECTRA***

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ABSTRACT

Traditionally, spectra from profiling millimeter wavelength Doppler radars are assumed to be approximately Gaussian in shape and adequately described by their first three moments. It is understood that Doppler spectrum shape depends on a convolution of particle microphysics with air dynamics, and the spatial and temporal filters of the radar. With sufficient filter resolution, however, observed spectra show significant departures from a Gaussian shape, illuminating underlying small scale microphysical processes. A case in point are the very non-Gaussian Doppler spectra frequently observed from the DOE ARM millimeter wavelength profiling radars, operating continuously at 35- and 94-GHz. The selected sampling strategies of these radars provide high-resolution (2 sec, 45 m) 256-point FFT Doppler spectra from clouds and precipitation. Using the long record of spectra now archived from the ARM sites, we present a “climatology” of Doppler spectrum morphological parameters such as skewness, kurtosis, left/right linear slope, and the number of significant peaks and local maxima, for different cloud and precipitation conditions. We discuss patterns that are revealed and their implications for microphysical retrievals based on profiling millimeter wavelength radars.